# Test of time reversal invariance violation in the beta-decay of $^{56}$Co

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Since the detection of *CP* violation in the neutral kaons,[1] there have been many attempts to detect the implied *T* violation in low energy phenomena. To date these searches have yielded no positive results, and for tests involving the beta-decay of the neutron the limits on *T* violation are quite small and are approaching limits of $10^{-4}$.[2] Of course, without a good idea of the mechanism for *T* violation, present results do not rule out the existence of large effects in other systems.

The present work on $^{56}$Co is motivated by the idea that *T* violation might appear through a mechamism that experiments involving allowed nuclear beta-decay are not sensitive to. One possibility is the existence of *T* violating second class currents. For the allowed decays of the neutron and $^{19}$Ne, the dominant terms must be first class and hence any second class term would be kinematically surpressed.

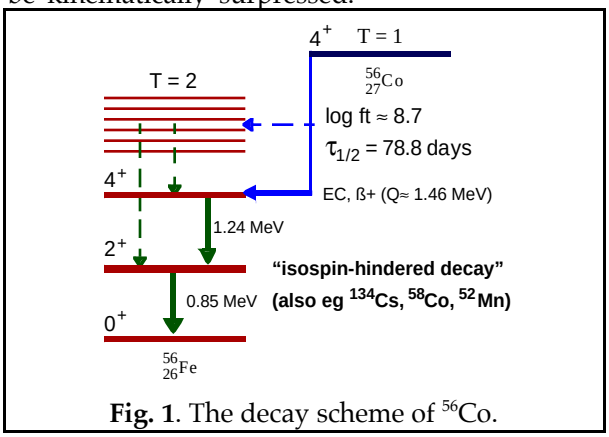


**Fig. 1**. The decay scheme of $^{56}$Co.

In the decay of $^{56}$Co this is not the case. Since it involves the decay between two different isospin multiplets (Fig. 1), the dominant terms need not necessarily be first class. The current limit on T violation in $^{56}$Co is at the level of $10^{-2}$. We intend to improve this by at least an order of magnitude.

The relevant correlation for the detection of TRIV is of the form $E1(J\bullet k)(J\bullet p\times k)$, where $J$ is the nuclear spin, $k$ is the gamma-ray momentum and $p$ is the beta-momentum. The required alignment will be achieved by low temperature nuclear orientation with an Oxford Kelvinox 400 that has been assembled and reaches temperatures of 5 mK. Unlike the previos effort,[3] this dilution refrigerator will be capable of maintaining a stable temperature for weeks in a single run. The gamma-rays from the excited state of $^{56}$Fe will be detected by conventional NaI(Tl) detectors. Besides stable refrigeration, the experiment has been improved by the development of a Si detector that operates at mK temperatures. [4] This allows the detector to be placed very near the $^{56}$Co source. A spectrum from $^{207}$Bi is shown in Fig. 2. Results will be obtained by early 1998.

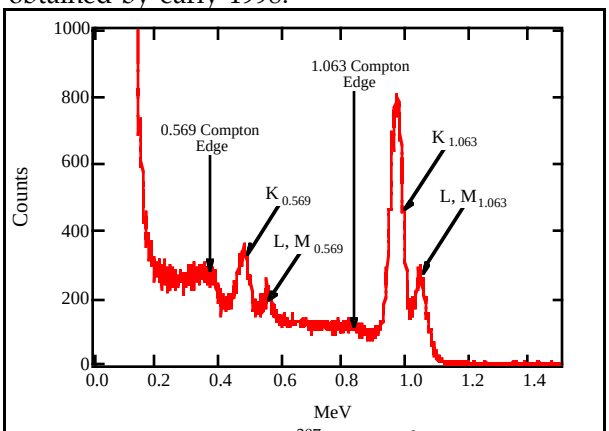


**Fig. 2.** Spectrum of $^{207}$Bi with Si detector operated at 100 mK.

*Footnotes and References*

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1. Christenson *et. al.*, Phys. Rev. Lett. **13**, 138 (1964).

2. E. G. Wasserman, thesis LA-12735-T.

3. Calaprice *et. al.*, Phys. Rev. C **15**, 381 (1977).

4. We gratefully acknowledge the support of B. Young for the fabrication of this device.